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NOTES ON GEOGRAPHIC DISTRIBUTION

Ameerega flavopicta (Lutz, 1925): First dart-poison frog (Anura: Dendrobatidae) recorded for the state of São Paulo, Brazil, with comments on its advertisement calls and taxonomy

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ABSTRACT: *Ameerega flavopicta* is a dart-poison frog (Dendrobatidae) widely distributed throughout rocky habitats in the Brazilian states of Minas Gerais, Goiás, Tocantins, Pará, and Maranhão. Here we report for the first record of a dendrobatid frog in the State of São Paulo, Brazil, based on individuals of *A. flavopicta* found at the Municipality of Pedregulho, and also describe the advertisement calls of a male from this population. A taxonomic discussion is provided.

Ameerega flavopicta (Lutz, 1925) (Dendrobatidae: Colostethinae) is a dart-poison frog described from Belo Horizonte, State of Minas Gerais, southeastern Brazil. Currently it is known to be widely distributed throughout the Brazilian states of Minas Gerais, Goiás, Tocantins, Pará, and Maranhão (see geographic distribution map and related references in Figure 1). This species is regarded as a diurnal breeder, usually found in rocky fields or riparian forests, along streams (Haddad and Martins 1994; Toledo *et al.* 2004; Costa *et al.* 2006; Magrini *et al.* 2010).

Herein we report for the first observation of *A. flavopicta* in the State of São Paulo, southeastern Brazil, and also describe the advertisement call of a male from this locality. We also discuss the taxonomic implications of our findings.

During recent fieldworks (December 2008 and October 2011) at the region of the Jaguara hydroelectric dam (Grande river), Municipality of Pedregulho, State of São Paulo, southeastern Brazil (southern margin of the dam), we noticed *Ameerega flavopicta* males calling in open rocky habitats, along temporary streams that drain into the dam. One calling male was collected on 23 October 2011, at 13:05 h, and is housed at the Amphibian Collection of the Universidade Federal de Uberlândia (Figure 2; voucher # AAG-UFU 0659; collecting permit ICMBio/SISBIO # 30059-2; collection GPS point: 20º08'20'' S, 47º18''31' W). Specimens of *A. flavopicta* were also commonly found in the northern margin of the dam (Municipality of Sacramento, State of Minas Gerais), where one specimen was collected (27 December 2008, ≈16:30 h; collection GPS point: 20º07'03'' S, 47º18'57'' W; voucher # AAG-UFU 4398).

The anuran fauna of the State of São Paulo is considered to be the most thoroughly surveyed in Brazil, in relation to the other states (Araújo *et al.* 2009; Rossa-Feres *et al.* 2011), but two regions still deserves additional studies

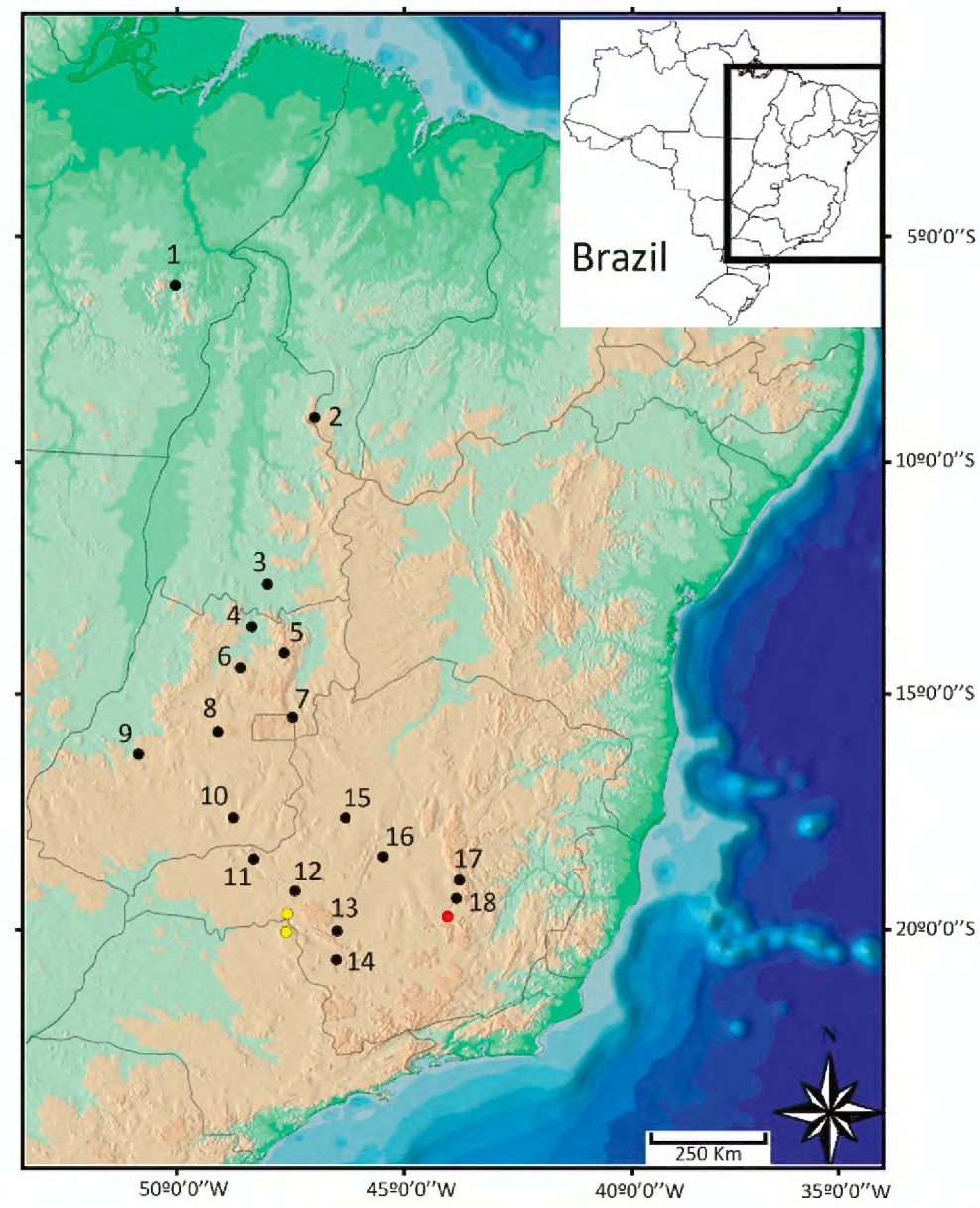

FIGURE 1. Geographic distribution of *Ameerega flavopicta*, as presently recognized. Red dot depicts the type-locality, Municipality of Belo Horizonte, State of Minas Gerais. Yellow dots represent records from the present study: municipalities of Sacramento, State of Minas Gerais (above) and Pedregulho, State of São Paulo (below). Black dots depict localities previously reported in the literature (Haddad and Martins 1994; Biavati *et al.* 2004; Toledo *et al.* 2004; Silveira 2006; Leite *et al.* 2008; Oda *et al.* 2009; Magrini *et al.* 2010; Torres and Eterovick 2010): State of Pará: 1- Parauapebas; State of Maranhão: 2- Amaro Leite; State of Tocantins: 3- Paranã; State of Goiás: 4- Minaçu, 5- Alto Paraíso de Goiás, 6- Niquelândia, 7- Formosa, 8- Pirenópolis, 9- Serra Dourada, 10- Caldas Novas; State of Minas Gerais: 11- Araguari, 12- Perdizes, 13- São Roque de Minas, 14- Alpinópolis, 15- João Pinheiro, 16- Três Marias, 17- Santana do Riacho, 18- Jaboticatubas.

(Rossa-Feres *et al.* 2011): the southwest of the state, around the Paranapanema river basin, and the northeast of the state, around the border with the State of Minas Gerais. The site where we found *A. flavopicta* is within this latter region, reinforcing the need of additional field studies there. Besides *A. flavopicta*, five other anuran species were recently registered for the first time in the State of São Paulo from this region: *Rhinella rubescens* (Lutz, 1925), *Phyllomedusa ayeaye* (Lutz, 1966), *Scinax canastrensis* (Cardoso and Haddad, 1982) and *Barycholos ternetzi* (Miranda-Ribeiro, 1937), reported by Araujo *et al.* (2007a,b; 2009), and *Leptodactylus syphax* Bokermann, 1969 reported by Martins and Silva (2009).

Figure 2. An adult *Ameerega flavopicta* collected at the Municipality of Pedregulho, State of São Paulo, Brazil, on 23 October 2011 (photo of live individual). Voucher housed at the Amphibian Collection of the Universidade Federal de Uberlândia, # AAG-UFU 0659.

At Pedregulho, an unvouchered male had advertisement calls recorded on 23 October 2011, around 11:35 h. Recordings were made using a M-audio Microtrack II digital recorder coupled to a Sennheiser ME66/K6 directional microphone, set to 48 KHz and 16 bit resolution. Sounds were analyzed using SoundRuler (Gridi-Papp 2007), and sonograms confected using the package Seewave (Sueur *et al.* 2008) of the R software (R Development Core Team 2010).

Analyzed calls (N = 15; Figure 3) consisted of a pulsed note (7.4 ± 0.7; 6–9 pulses), that lasts 107.0 ± 6.7 (91.3–124.2) ms, with a slight increase in frequency: dominant frequency of 3589 ± 30 (3561–3608) Hz at the start, and 3802 ± 33 (3749–3842) Hz in the end of the note. This note is repeated at a rate of about 145 notes per minute, with inter-note intervals of 300.1 ± 29.8 (272.5–403.1) ms.

Advertisement calls of *A. flavopicta* were already described for others populations (see a compilation of these data in Table 1). Our data, in general, agree with these descriptions, but a larger sample size is needed for a formal, statistically based comparison between them, and it is beyond the aim of the present work.

Costa *et al.* (2006) reported geographical variation in the advertisement calls and tadpoles of specimens of *A. flavopicta* from Caldas Novas, State of Goiás, in relation to those previously described from Santana do Riacho, State of Minas Gerais (Haddad and Martins 1994). Later, Magrini *et al.* (2010) based on broader samples, reported significant variation in the advertisement calls of specimens from Caldas Novas, when compared to populations from Minas Gerais.

Haddad and Martins (1994) reported distinctive morphological variation in specimens of *A. flavopicta* from the State of Pará, and commented that future bioacoustic analyses should help in the clarification of the taxonomic status of this population, but their advertisement calls are still unknown.

Lötters *et al.* (2009) described *Ameerega boehmei* Lötters, Schmitz, Reichle, Rödder, and Quennet, 2009 based on specimens previously considered to be from a Bolivian population of *A. flavopicta*. This species is genetically and morphologically very similar to *A. flavopicta*, but clearly differs in advertisement call features (Lötters *et al.* 2009).

All these studies are suggestive of the need of a broader taxonomic evaluation of the populations of *Ameerega flavopicta*, as variation in advertisement calls and larval morphology were already reported, and the populations from the states of Pará, Tocantins and Maranhão remain poorly known. Integrative approaches including molecular, morphological and acoustic data, as done by Lötters *et al.* (2009), should help in clarifying the taxonomic status of these populations.

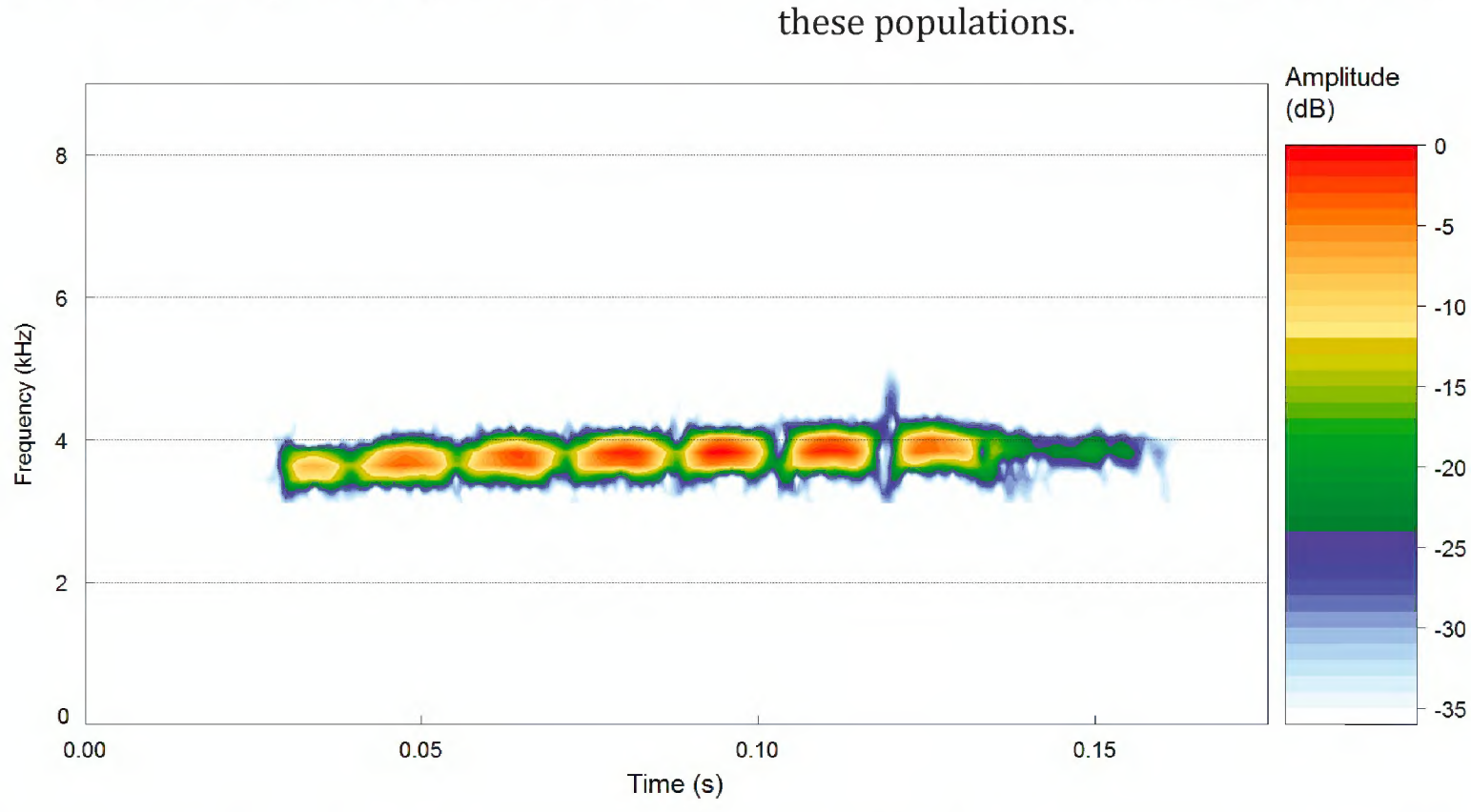

Figure 3. Spectrogram of an advertisement call of *Ameerega flavopicta*. Recorded at the region of the Jaguara hydroelectric dam, Municipality of Pedregulho, State of São Paulo, Brazil. 23 October 2011, 13:05 h; temperature data not available. Record file: Ameerega_flavopicSP1LBM_AAGmt.

Table 1. Advertisement call features of *Ameerega flavopicta*. Data from the present study and literature.

LOCALITIES AND LITERATURE SOURCES	NOTE DURATION (ms)	PULSES PER NOTE	INTER-NOTE INTERVAL (ms)	NOTES PER MINUTE	DOMINANT FREQUENCIES OF THE NOTE (Hz)	
					BEGINNING	END
State of São Paulo:						
Pedregulho (present study)	107 91–124	7.4 6–9	300 273–403	145	3589 3561–3608	3802 3749–3842
State of Minas Gerais:						
Alpinópolis (Haddad *et al.* 1988)	---------	6	550	---------	Frequency band from 3100 to 3700	Frequency band from 3400 to 4000
Santana do Riacho (Haddad and Martins 1994)	110	6	480–630	---------	Frequency band from 3200 to 4200 (modulation confirmed, but not analyzed)	
Santana do Riacho (Magrini *et al.* 2010)	150 110–180	6–10	460 330–690	78–129	3203 2878–3457	3503 3292–3705
Araguari (Magrini *et al.* 2010)	110 100–130	7–9	310 250–420	123–146	3708 3457–3981	4045 3788–4285
Perdizes (Magrini *et al.* 2010)	170 160–180	6–9	430 360–500	94–109	3561 3181–3954	3889 3374–4340
State of Goiás:						
Alto Paraíso de Goiás (Toledo *et al.* 2004)	92 71–98	4–6	308 237–486	169	Dominant frequency ≈ 3700–3800 (modulation confirmed, but not analyzed)	
Caldas Novas (Costa *et al.* 2006)	144	7–8	292	139	3200	4050
Caldas Novas (Magrini *et al.* 2010)	110 90–150	6–8	260 230–290	140–175	3723 3319–4119	4016 3650–4367

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